

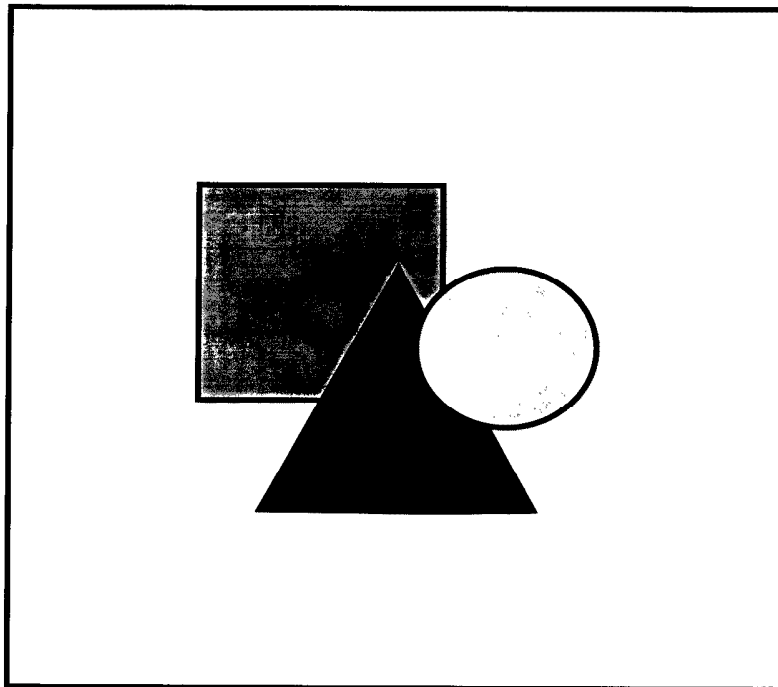
Enology

**For a long time there has been the suspicion that “cork taste“ can be caused also by other products than contaminated cork stoppers. As strange as it may seem, this concerns in particular well cleaned cellars...**

# Cork taste without cork?



*Text: Horst Rudy (left) and Gerd Scholten, DLR Mose (Research Institute Mosel), Trier*



Can a wine present cork taste even if it never came into contact with a cork stopper?

The answer is: No!

But if the wine is contaminated with TBA, every now and then the impression of a cork taste arises (photo: bb)

When in the middle of the 1980s 2,4,6-Trichloranisol (generally known as TCA) was discovered as the main cause of cork taste, it was at that time already discussed whether this substance is responsible for all cases of cork taste. There were discovered again and again also other sensorial similar substances (e.g. geosmin and 2-Methylsoborneol, 2-MIB), but only to an extremely small extent.

As a cause of cork taste were recognized not only cork stoppers but also the in former times frequently used disinfectant Pentachlorophenol (PCP, commercially known among others as ‘Raco’). In PCP was contained among others the pollutant 2,3,4,6-Tetrachlorophenol, a combination that is converted from micro organisms to 2,3,4,6-Tetrachloranisol (2,3,4,6-TeCA, TeCA), which can likewise cause cork taste in wine. 2,3,4,6- Tetrachlorophenol develops also during the microbiological decomposition of different pesticides. PCP was used in the wine industry particularly for wood preservation, for example of pallets. Due to the fact that PCP was clearly carcinogenic in animal experiences, its use is forbidden since 1989. In order to protect wood and cardboard boxes nevertheless from micro organisms, particularly from cellulose utilizers like fungus, 2,4,6-Tribromphenol (TBP) was used as an alternative. The substance acts just like the PCP fungicide and additionally as a flame protection product. Because of the fire retardant effect of TBP, also plastics and paints are mixed with it. Unfortunately under certain circumstances a molecule named 2,4,6-Tribromanisol (2,4,6-TBA, TBA) can be formed. From the sensory point of view the substance is described with attributes like ‘mould, earth, chemical, smelling like solvents’.

### Case N<sup>o</sup>. 1: Plastic closures with mould smell

Case N<sup>o</sup>. 1: A manufacturer of plastic closures described end of 2004 a case, where synthetic closures were transported in a ship from the USA to Europe and they presented clearly a mouldy smell on their arrival. After having passed through lab analyses it turned out that the cause of the ‘cork taste’ was 2,4,6-TBA. Investigation carried through by the manufacturer resulted in that just before sailing; the loading space of the ship was intensively cleaned with a steam jet. The high air humidity and the unsatisfactory ventilation created optimal living conditions for the micro organisms, which during the sea trip formed TBA from TBP. The presence of TBA could be proven in the timber flooring and in the painting of the container walls. TBA is like TCA and other non-polar substances in plastics outstandingly soluble and was therefore accumulated in the packing foils of the synthetic closures. As the synthetic closures consist likewise of plastic, the TBA moved through the plastic foil and accumulated itself also in the synthetic closures. But not all synthetic closures were equally affected. The closures which were in direct proximity of the packing cardboard were clearly more strongly affected than the closures that were in the middle of the bags. The manufacturer of synthetic closures imposed therefore stricter conditions for hauliers and dealers, additionally he purchased packing bags made of a more dense material.

Table 1: 2,4,6-TBA contents of the samples of case N<sup>o</sup> 2

	2,4,6-TBA (ng/kg)
Wine Nr. 1	8,4
Wine Nr.2	11,1
Packing cardboard from the cellar	60

In order to be able to compare the contents, all values are indicated in ng/kg

Table 2: 2,4,6-TBA contents of the samples of case N° 3

Sample designation	2,4,6-TBA (ng/kg)
Wine Nr. 1 (natural cork)	10,1
Wine Nr. 2 (natural cork)	12,9
Wine Nr. 3 (natural cork)	4,4
Wine Nr. 4 (natural cork)	2,7
Wine Nr. 5 (natural cork)	12,3
Wine Nr. 6 (natural cork)	3,3
Wine Nr. 7 (natural cork)	6,5
Wine Nr. 8 (natural cork)	4,6
Foil packing; filter layers	900
Filter layer	260

In order to be able to compare the contents, all values are indicated in ng/kg

### Case Nr°. 2: Cardboard boxes

Case Nr°.2: The request for registration of all the wines from a winegrower in the Mosel region was rejected due to cork taste. No problems arose before in that respect. In contrast to the classical 2,4,6-TCA that causes cork taste, the default taste can be found in all bottles of a bottling. An analysis done at the Institute DLR Mosel determined the combination 2,4,6-TBA as a cause for the „cork“ taste. Additional analyses expose cardboard boxes from the repackaging of bottles as a source of contamination. In the discussion with the winegrower it turns out that the cardboard boxes are stored in the same badly ventilated area directly next to the bottling line. Very probably the steaming of the bottling line supplied sufficient humidity, in order to enable the transformation of TBP into TBA. An aggravating circumstance is the fact that TBA, similar as TCA, causes also a fast habituation. Simply expressed: after a certain period of time we do not notice the mouldy smell anymore. (Table 1).

### Case Nr°. 3: Filter Layers

Case Nr°. 3: A winegrower presents his cork supplier a complaint about strong cork taste. However, the analytic test of the wines results in no TCA contamination coming from the corks, but in an intensive contamination caused by TBA. Further investigations proved the presence of TBA also in other substances in this cellar, among other things in filter layers and plastic foils. Due to the high TBA contents, which could be proven in the filter layers, there is the assumption that TBA was rinsed during the bottling from the filter layers into the wine. The very different concentrations in the individual wines pointed it out.

### Overview: TCA & TCB

	<b>2,4,6-TCA</b>	<b>2,4,6-TBA</b>
<b>Structure</b>	$\begin{array}{c} \text{O} - \text{CH}_2 \\   \\ \text{Cl} \quad \quad \quad \text{Cl} \\   \\ \text{Cl} \end{array}$	$\begin{array}{c} \text{O} - \text{CH}_2 \\   \\ \text{Br} \quad \quad \quad \text{Br} \\   \\ \text{Br} \end{array}$
<b>Source</b>	Cork stoppers	cardboard (paper), plastics, textiles, wood, varnishes, paints
<b>Smell threshold</b>	Approx. 1,4 to 3 ng/L in wine	Approx. 3,4 to 7,9 ng/L in wine
<b>Sensory Quality</b>	Typical cork taste	mouldy, earth, chemical, similar as 2,4,6-TCA

### How does 2,4,6-Tribromanisole develop?

The tri bromine anisole problem has already been well-known for several years from the analytics of drinking water. The way it develops is similar to that of TCA. When substances containing tribromophenole (wood pallets, cardboard boxes, textiles, plastics, varnishes and paints) are stored in a humid, if possible warm, badly ventilated atmosphere, as a decontamination reaction, micro organisms transform part of the TBP into TBA. In an American dairy during the first fillings of the day there was found over a certain period of time a mouldy, earthy taste. Finally the cause of contamination was determined to be a tube with tribromophenole. At night, when the tube was filled with air only, micro organisms transformed TBP into TBA. During the day, when fillings took place, the first fillings were always clearly mouldy, until the TBA that was transformed was completely rinsed from the tube. The following fillings were then perfect from the sensory point of view.

ID: 14543376	<b>Der Deutsche Weinbau (</b>	Tiragem: 0	Página: .
Data: 21-07-2006		Pais: Alemanha Âmbito: Informação Geral Perid.: Diária	Corés: Preto e Branco Área: 16,25X24,01 cm2 Corte: 5 de 6

### **How can TBA enter into wine?**

The investigations we carried through during the last few years, showed the presence of TBA in:

- synthetic closures
- filter layers
- wood pallets
- cardboard boxes
- plastic re-packaging material
- plastic seals of crown corks (basic wines for sparkling wine)
- plastic seals of screw caps

TBA is a non-polar molecule with a relatively high steam pressure, i.e. the substance changes into the surrounding atmosphere. This way the TBA can contaminate also other substances in the cellar. Therefore it is often difficult to find out the exact cause, because TBA is distributed over the atmosphere and can then enriches itself in suitable substances. The difficulty is the fact that cork taste develops only slowly and depending upon humidity and air temperature. The problem is that often particularly well cleaned cellars are affected by this. In this connection and in particular the frequent use of steam jets is problematic.

### **Which are the precautionary measures that have to be taken?**

It is recommended to urgently avoid the combination of wood, pasteboard and humidity. Above all, all substances that will come into contact with the wine (in particular filter layers, all plastics, adsorbents such as bentonite and A-coal) should be stored in a ventilated area. Wood pallets and cardboard boxes, e.g. from bottle packaging should be kept in a separate room from these articles. You should avoid the use of varnishes and paints with fire-retardant additives. When it is inevitable, you should pay attention at least to ventilate these areas well.

### **How can we differentiate between the causes of cork taste?**

The same technology, which is used in forensic medicine or also in doping analytics, makes it possible to also differentiate the various causes. A method is the sample preparation based on gas chromatography – mass spectrometry (GC-MS) in combination with stir bar sorptive extraction (SESE), with which the different causes of cork taste can be proven free of doubt. The method is so efficient that we can determine also contents under the respective threshold limit.

### **Sensory effects of a 2,4,6-TBA contamination**

The taste threshold of 2,4,6-TBA is somewhat higher than that of 2,4,6-TCA. Contents of 2,4,6-TBA until approx. 5 ng/L cause, depending on the wine, usually only a masking of the typical fruit aroma, the wine loses clearly its quality. Higher contents of 2,4,6-TBA, from approx. 9 ng/L onwards, cause a taste similar to that of cork taste, but in direct comparison it presents a distinguishable sensory taste.

ID: 14543376	<b>Der Deutsche Weinbau (</b>	Tiragem: 0	Página: .
Data: 21-07-2006		País: Alemanha	Cores: Preto e Branco
		Âmbito: Informação Geral	Área: 17,07X7,75 cm2
		Períod.: Diária	Corte: 6 de 6

## **Can we „save“wines that are contaminated with TBA?**

Here applies the same as with wines that are contaminated with the true cork taste caused by 2,4,6,- TCA: light cork taste can be clarified through moderate activated carbon treatment, but with degradation of quality. When there is a strong cork taste, we need to use such high quantities of activated carbon, that practically all aroma substances are also removed. Such wines are irrevocably damaged.

### **Do you have questions?**

Our authors reply to all questions to this report by email:

horst.rudy@dlr.rlp.de

gerd.scholten@dlr.rlp.de